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Searching for Hyper-Velocity Stars

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Abstract. We present our survey for subluminal hyper-velocity candidates, which has been successfully initiated at the ESO NTT and the Calar Alto 3.5 m telescope.

A natural consequence of the presence of a super-massive black hole in the centre of our Galaxy is the existence of dynamically ejected stars, called hyper-velocity stars (HVS). Up to now ten HVSs are known that have Galactic rest-frame velocities exceeding the escape velocity of the Galaxy and are therefore unbound. To date only one of those, the subluminal O star US 708 (Hirsch et al. 2005), belongs to an old population of evolved stars. Brown et al. (2007) found 26 bound late-B-type HVSs with $v_{GRF} > 275 \text{ km s}^{-1}$ but only one bound HVS with $v_{GRF} < -275 \text{ km s}^{-1}$ supporting the perception that late-B-type HVSs are short-lived main sequence rather than long-lived HB stars. If such a bound population of hot subdwarf stars, no asymmetry in the radial velocity distribution is expected to occur because these stars are long lived. Hence there should also be a population of subdwarf stars moving towards us at high speed.

Therefore we embarked on a search for new HVSs among subdwarf O and B stars (unbound or bound). An excellent starting point is the enormous data base of the Sloan Digital Sky Survey (SDSS). By means of spectral classification a number of sdOB HVS candidates has been extracted, which we follow-up presently.

In order to rule out radial velocity variability, hence an indication for binarity, we need to take two spectra. By determining the atmospheric parameters we estimate the spectroscopic distance. Calculating possible trajectories from the GC we derive information about the ejection velocity, the time of flight and can predict the corresponding proper motions, which are expected to be so small that they can probably be verified only by means of the GAIA satellite mission.

Our first observing run was scheduled for February 2007 at the Calar Alto 3.5 m telescope and was clouded out completely. Observations at the ESO NTT have recently finished and are currently analysed. The survey will be continued by observations at the Calar Alto observatory and the ESO VLT in spring/summer of 2008.

References

- Brown, W. R., Geller, M. J., Kenyon, S. J., et al. 2007, ApJ 660, 311
Hirsch, H. A., Heber, U., O'Toole, S. J., & Bresolin, F. 2005, A&A 444, L61